朝比奈泰彦*: 地衣類雑記 (§ 99)

Yasuhiko ASAHINA*: Lichenologische Notizen (§ 99)

§ 99. A new method in describing the relation between cortex, medulla and axis of Usneae.

Usnea is the unique genus among lichens, which has highly developed and well differentiated cortex, medulla and axis. The mutual breadth of of medulla and axis, together with their contexture and color make important items in characterizing an *Usnea* species. In older literatures we find such expressions as "axis tenuis," "medulla crassa" etc., without giving any standard.

Motyka[1] gave in his eminent work numerical values of cortex, medulla and axis of each species. But these figures are of little value, unless the exact position in the thallus was definitely mentioned. Motyka recommends to cut the branch at the upper portion from the middle of the thallus. Steiner[2] seems to be the first, who utilized the thickness of the cortex to systematize *Usneae*. But his method was not further developed by the subsequent lichenologists.

Instead of giving arbitrary numerical values I propose to use their ratio, which I call "**RS**" (abbreviated from "Ratio stratorum"), taking the thickness of the cortex as unit. Let c, m and a be the thickness of cortex, medulla and axis of a section respectively, then

RS of this species $= 1 : m/c : a/c$.

By the calculation of RS value we may add another important factor in identifying *Usnea* species.

In many species the **RS** values of the same branch, except undermost and apical parts, are almost constant throughout the total length. At least this is the case with species of regularly attenuate stems and branches.

In case of inflated thalli the **RS** values show notable fluctuation according to the position of the section, so that it must be more accurately defined whether the section was made at the most thickened point or at a regularly

1) Lichenum Generis Usnea Studium Monographicum, pars systematica.

2) *Ibid.*, pars generalis, p. (158).

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attenuate region of the thallus. Under these limitations every individual of one and the same species shows almost approximate **RS** values. However the cortical layers of various *Usnea* species are very often uneven, the axes are deformed and eccentrically situated in the medullae. To adjust such irregularities an average thickness of each layer is calculated in following way.

A section of thallus is immersed in glycerine-alcohol-water (1 : 1 : 1) and gently warmed to drive air bubbles. Then measure the thickness of each layer along two crossed diameters (Fig. 1) and find the arithmetical means of these data:

$$c = 1/4\ (c_1+c_2+c_3+c_4),$$
$$m = 1/4\ (m_1+m_2+m_3+m_4),$$
$$a = 1/2\ (a_1+a_2).$$

Graphic Expression of "**RS.**"

To compare several **RS** values of the same or different species, it is more convenient to use their graphs instead of numerical values. Let the **RS** of a section be 1 : 4.2 : 3.6. Draw a horizontal straight line oX, which is called the base line (Fig. 2). Take three points a, m, and c on it, so that $oa = 1/2 \times 3.6$, $am = 4.2$ and $mc = 1$. The straight line oc itself is the simplest graph of this **RS**, because therewith we are able to reconstruct the section virtually as it is shown in the underside of the base line oX. Practically I adopt another method. Draw aA(=3.6), mM(=4.2) and cC(=1) perpendi-

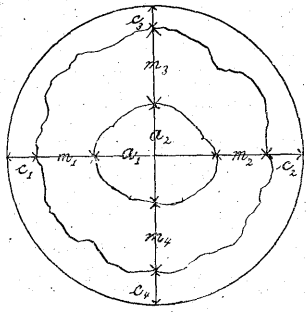

Fig. 1

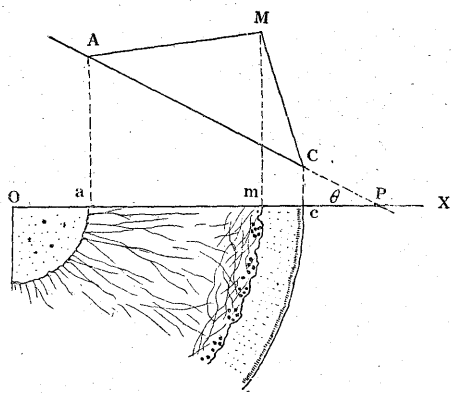

Fig. 2

cular to oX. Join A and M, M and C, A and C. The straight line AC meets with oX at P. I call the triangle AMC the graph of **RS**=1 : 4.2 : 3.6 with respect to the base line oX. The acute angle θ at P varies in corelation with the thickness of cortex, medulla and axis. When a and c remain constant, then the greater m, the smaller becomes θ and vice versa. If the point M lies on the outside of the line AC as in the case of Fig. 2, the

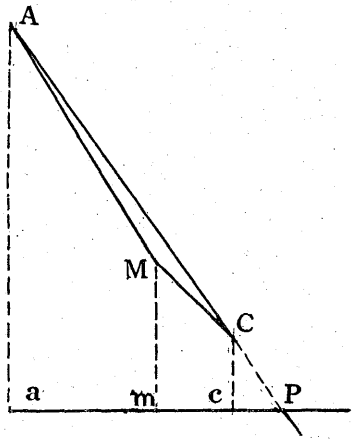

Fig. 3

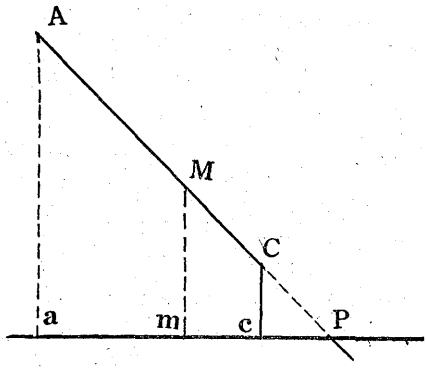

Fig. 4

graph is said to be of exterior type, which is always the case with species of broad medulla. On the other hand, if the point M lies within AC, the graph is called interior. All species with narrow medulla belong to this class. Fig. 3 demonstrates the **RS**=1 : 2 : 5, θ=ca 54.° When **RS**=1 : 2 : 4, then the point M lies on the straight line AC, θ being equal to 45°. (Fig 4). Also three points A, M and and C of the graph of **RS**=1 : 2.3 : 5 lie practically on the straight line AC, θ being ca 50°. Generally speaking, if the diameter of axis is less than double breadth of medulla, the graphs become decidedly exterior. On the dontrary, if the diameter of axis is greater than or equal to double breadth of medulla, the graphs belong partly to interior, partly to exterior type. In the latter case the point M lies very near to the line AC. As a special case it may occur that the point M lies on the line AC. I have not yet met with cases, in which the diameter of axis is less than the breadth of cortex. Also **RS** 1 : 1 : 1, if really exists, may be an extraordinary case, as the line AMC is parallel to the base line.

One may raise an objection to the **RS** method, that I have treated the plastic tissue of lichen too much mechanically. Indeed, **RS** value of a species is not strictly constant and **RS** alone can give no ultimate decision. Nevertheless I am quite convinced that by the measurement of the **RS** values we can secure more accurate perception of the thallus of *Usneae* in question, excluding any absurd determination.

Examples[3)]

1. **Usnea hirta** (L.) Wigg.

This species is characterized by its comparatively thin cortex and broader medulla. The graphs of **RS** values are all of exterior type.

Specimen 1: Flora Danica, Sjaelland—leg. M. S. Christiansen (no. 8125).

c: m: a=57: 197: 279. **RS**=1: 3.4: 4.8. $\theta=41°$.

Specimen 2: Plantae Suecicae, Verstergötland—leg. C. Stenholm.

c: m: a=72: 270: 390. **RS**=1: 3.8: 5.4. $\theta=43°$.

Specimen 3: Plantae helveticae, Finsterbach—leg. E. Vayhinger.

c: m: a=37: 345: 270. **RS**=1: 8.1: 7.3. $\theta=35°$.

Specimen 4: Plantae helveticae, Oberengadin—leg. E. Vayhinger.

c: m: a=69: 273: 295. **RS**=1: 4: 4.3. $\theta=34°$.

Usnea hirta ssp. **villosa** (Ach.) Mot. apud Motyka, Monogr., p. 96:

c: m: a=80: 250: 220. **RS**=1: 3.1: 2.75. $\theta=26°$.

Usnea hirta ssp. **helvetica** (Ach.) Mot. apud Motyka, Monogr., p. 100:

c: m: a=60: 200: 400. **RS**=1: 3.33: 6.66. $\theta=52°$.

2. **Usnea sorediifera** (Auctor.) Mot.

When the characteristic soralia are not sufficiently developed, this species is often mistaken with *U. comosa*, from which may be easily distinguished by the thinner cortex and broader medulla. The graphs of **RS** are all of exterior type.

Specimen 5: Lapponia, sub *U. barbata*—leg. P. J. & E. V. Hellbom.

c: m: a=65: 229: 262. **RS**=1: 3.5: 4. $\theta=34°$.

Specimen 6: Lich. Suecici, Jämtlandia—leg. G. Ohrstedt (sub *U. hirta* f. *sorediella* Br. & Rostr.

c: m: a=41: 164: 213. **RS**=1: 4: 5.2. $\theta=40°$.

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3) To save space I abandonned to attach the graphs. The readers will easily reproduce them and be convinced of their utility.

Specimen 7: Lich. Suecici, Söderala—leg. E. P. Vrang.

c: m: a=50: 270: 344. **RS**=1: 5.4: 6.8. $\theta=44°$.

Usnea sorediifera (Auctor.) Mot. apud Motyka, Monogr., p. 287:

c: m: a=60: 220: 180. **RS**=1: 3.67: 3. $\theta=24°$.

3. **Usnea comosa** (Ach.) Röhl.

This species has comparatively thin medulla, which is hardly twice so thick as cortex and much thicker axis, so that the graphs of **RS** values are in general of interior type. Sometimes the graph appears as exterior type, then the point M lies very near to the line AC. Very often the points A, M and C lie on a straight line.

Speciemen 8: Flora Danica[4], Sjaelland—leg. M. S. Christiansen (10431, K+).

c: m: a=69: 104: 580. **RS**=1: 1.5: 8.4. $\theta=72°$.

Specimen 9: Flora Danica, Jylland—leg. M. S. Christiansen (8580, K+).

c: m: a=100: 164: 416. **RS**=1: 1.64: 4.16. $\theta=50°$.

Specimen 10: Flora Danica, Jylland—leg. M. S. Christiansen (8528, K+).

c: m: a=75: 150: 477. **RS**=1: 2: 6.4. $\theta=61°$.

Specimen 11: Flora Danica, Jylland—leg. M. S. Christiansen (8528 p.p., K−).

c: m: a=81: 212: 335. **RS**=1: 2.6: 4.1. $\theta=42°$. (exterior).

Specimen 12: an admixed individual in Kryptog. Exsicc. Vindob. 2768 (sub *U. dasypoga*, K−).

c: m: a=132: 245: 530. **RS**=1: 2.3: 5. $\theta=50°$. A, M, C on a straight line.

c: m: a=131: 115: 610. **RS**=1: 0.88: 4.4. $\theta=62°$.

Specimen 13: Lich. Scand., Gottland—leg. H. Magnusson (sub *U. barbata* v. *sorediifera* Arn., K+).

c: m: a=90: 120: 575. **RS**=1: 1.3: 6.4. $\theta=66°$.

c: m: a=130: 147: 700. **RS**=1: 1.1: 5.4. $\theta=64°$.

Specimen 14: Flora von Westfalen—leg. W. Schemman (sub *U. barbata* v. *florida* Kbr. K+).

c: m: a=68: 137: 285. **RS**=1: 2: 4. $\theta=45$. A, M, C on a straight line).

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[4] Mr. Christiansen was kind enough to send me these Danish lichens, for which I thank him here again. The reaction K+ of *U. comosa* is due to the presence of thamnolic acid. Those specimens (K−) contained squamatic acid.

Usnea comosa (Ach.) Röhl. apud Motyka, Monogr., p. 265:

c: m: a=100: 200: 380. **RS**=1: 2: 3.8. θ=43°.

Usnea comosa ssp. **similis** Mot. apud Motyka, Monogr., p. 270:

c: m: a=70: 150: 300. **RS**=1: 2.1: 4.3. θ=46°.

Usnea comosa ssp. **glaucina** Mot. apud Motyka, Monogr., p. 274:

c: m: a=70: 200: 450. **RS**=1: 2.8: 6.4. θ=54°.

4. **Usnea rubescens** Stirt.

With respect to the **RS** values this species show almost identical numbers with those of *Usnea rubicunda* Stirt. But they are distinctly separated by the mode of ramification and chemical reaction.

Specimen 15: Daito, Prov. Kazusa, Japan—leg. M. Togashi.

(middle) c: m: a=164: 262: 458. **RS**=1: 1.6: 2.8. θ=36°.

(upper p.) c: m: a=49: 149: 204. **RS**=1: 2.85: 4.2. θ=41°.

Specimen 16: Arashiyama, prope Kyoto, Japan—leg. Y. Asahina.

c: m: a=123: 196: 360. **RS**=1: 1.6: 2.95. θ=38°.

Specimen 17: Mt. Arisan, Formosa—leg. Y. Asahina.

c: m: a=120: 200: 400. **RS**=1: 1.66: 3.33. θ=42°.

Usnea rubescens Stirt. apud Motyka, Monogr., p. 347:

c: m: a=90: 140: 300. **RS**=1: 1.55: 3.33. θ=42°.

5. **Usnea rubicunda** Stirt.

Specimen 18: Funakoshi, Prov. Harima, Japan—leg. K. Uchimi.

(middle) c: m: a=147: 164: 460. **RS**=1: 1.11: 3.1. θ=48°.

(upper p.) c: m: a=73: 98: 236. **RS**=1: 1.3: 3.2. θ=45°.

Specimen 19: Minoo, Prov. Settu, Japan—leg. N. Ui.

c: m: a=108: 152: 425. **RS**=1: 1.5: 4.0. θ=50°.

Specimen 20: Mt. Arisan, Formosa—leg. Y. Asahina.

(middle) c: m: a=131: 238: 377. **RS**=1: 1.8: 2.88. θ=36°.

(upper p.) c: m: a=65: 130: 237. **RS**=1: 2: 3.65. θ=42°.

Usnea rubicunda Stirt. apud Motyka, Monogr., p. 430:

c: m: a=180: 150: 350. **RS**=1: 0.83: 1.95. θ=27°.

This value seems to be an extraordinary one—the axis is too small in proportion to the cortex.

6. **Usnea aciculifera** Wain.

One of the most common *Usneae* in Japan, having almost regularly cylindrical and gradually attenuate branches, Graphs of its **RS** values are in

general narrow triangles, whose vertices M lying very near to the side AC.

Specimen 21: Yamanaka, Mt. Fuji, Japan—leg. M. Togashi.

(middle) c: m: a=65: 262: 450. **RS**=1: 4: 6.7. $\theta=49°$.

(upper p.) c: m: a=41: 130: 340. **RS**=1: 3.2: 7.4. $\theta=57°$.

Specimen 22: Subashiri, Mt. Fuji, Japan—leg. Y. Asahina (114).

c: m: a=84: 147: 327. **RS**=1: 1.76: 3.9. $\theta=48°$.

Specimen 23: Yamanaka, Mt. Fuji, Japan—leg. Y. Asahina (1405).

c: m: a=49: 130: 300. **RS**=1: 2.6: 6.0. $\theta=54°$.

Specimen 24: Hakone, Prov. Sagami, Japan—leg, M. Togashi.

c: m: a=85: 164: 458. **RS**=1: 2: 5.5. $\theta=57°$.

Usnea aciculifera Wain. apud Motyka, Monogr., p. 323:

c: m: a=40: 150: 250. **RS**=1: 2.6: 6.3. $\theta=55°$.

今回筆者は *Usnea* 類の記載に当り形態的の一要素として枝条の横断面に於ける皮層，髄層及び中軸の幅の比を皮層の厚さを単位として示すことを提案する。従来の種の記載は極めて粗略で“髄広い”とか“中軸稍細い”とか云う不確定な，標準のない抽象的の表現をして居る。又往々皮，髄，軸の実際の数値を与えて居る場合でも其の切断場所が不明では比較することができない。今或る枝の直角断面に於ける皮，髄，軸の数値（μ 単位）を夫々 c, m, a とすれば全体を c で除したものの比（之を **RS** と云う）を計算する：

$$\mathbf{RS}=1:\ m/c:\ a/c.$$

但し *Usnea* 類の内には皮層の厚さが甚しく不同であるもの少からず又中軸の断面も正円ではなく且つ髄の中に偏在して居るので軸の中心を通る略直角に交叉する両直径に沿うて測定し其の平均値を用うることにした。

勿論此の **RS** が或種の標徴である為には，同一の種であればどの個体のどの部分を切つても同一の **RS** を示さねばならない。かかる数学的の正確を変化の多い地衣体で要求するのは無理なことで或る範囲の動揺を考慮すれば形態的の一要素として利用することができる。今迄の経験では *Usnea* 類の中でも莖条が基部から先端迄殆ど同筒形をなし漸尖するものでは可なり恒一の **RS** を与える。又枝条が中央部又は先の方で膨脹 (inflate) し髄が比較的広いものでは断面の場所によつて著しい動揺があるがこの場合でも其の断面の場所を限定すれば互に比較ができる。猶此の **RS** 値を図示することで多くの標本の **RS** を速に比較することができる。筆者の今回の考案は植物鑑定に際し屢々濫用されつつある“勘”なるものを追放する意図に出でたものである。“勘”とは熟練によつて自得した概念で，正しき結論に達する端緒には違いないが勘の持主のみに通用するもので他人から見れば独断以外の何者でもない。科学的には是非客観的証拠の裏付けで他人を納得せしめなければならない。